Transesophageal Pacing as a Method of Control after Radiofrequency Catheter Ablation for Patients with Atrial Flutter

O. KALEJS, J. JIRGENSONS, N. NESTEROVICS, M. BLUMBERGS, J. ANSABERGS, S. SAKNE
Department of Surgical Arrhythmology, Riga Stradina University, Riga, Lettland

Summary

Temporary cardiac pacing is widely used for both diagnostic and medical purposes. Invasive or intracardiac electrophysiological research (IEPR) is extensively used in clinical work to localize additional conduction pathways, the "reentry" mechanism, ectopic foci and much more. Due to the drawbacks of IEPR, we have chosen transesophageal pacing (TE P) to obtain information about the cardiac conduction system. TE P can be used for the following purposes: determining the sino-auricular node functions; the atrioventricular (AV) and ventriculoatrial (VA) conduction pathways; diagnosing additional latent AV and hidden VA conduction pathways; to effectively treat arrhythmias; in researching the mechanisms of arrhythmia; in the treatment of paroxysmal supraventricular arrhythmias, and in some individual cases of ventricular arrhythmia. TE P is relatively simple to perform. Results in fewer complications can be used in the ambulatory setting and provides sufficient information to diagnose pathology of the cardiac conduction system.

Key Words

Transesophageal pacing, radiofrequency catheter ablation, atrial flutter, atrial fibrillation, intracardiac electrophysiological research

Introduction

From November 1997 through May 1999, 146 radiofrequency catheter ablations (RFCA) were performed on patients with cardiac arrhythmias in the Department of Surgical Arrhythmology of the Cardiology Clinic at Riga Stradina University. The age range was 15-82 years; 56% were female, 44% were male. Figure 1 shows the disease distribution. Patients participating in the study experienced atrial flutter and atrial fibrillation (AF) that was resistant to medical intervention and met the criteria of Brignole et al. [5] that are widely accepted in Europe. On patients with permanent AF, His bundle RFCA, followed by VVIR type pacemaker (PM) implantation (BIOTRONIK, Pacesetter), was performed after the achievement of AV block. On patients with continuous relapsing AF, His bundle RFCA, followed by DDDR PM implantation was performed. The Maze surgical procedure on the right atrium was performed prior to the RFCA according to the schemes in Figure 2 [1-4].

During the postoperative period, patients were monitored using classical ECG methods, 24-hour Holter-M inscription (GeTaMed, BIOTRONIK), Echo-cg, and stress testing if necessary, according to the method accepted in the clinic [6]. On patients that still experienced atrial flutter, RFCA was performed in the right atrium [according to F. Cosio demonstrated graph Vienna 1997, Prague, 1999], the examination method and postoperative control were similar to the other patients [7]. RFCA was performed with Al-Cath electrodes (BIOTRONIK) of various radi; the operation inscriptions were made with a CardioCOMP-2 (Cordelectro), an ADA-100 ablation generator (Cordelectro) and an Ab/Control 01 (BIOTRONIK).
The frequency of the paroxysms before and after the procedure was one of the basic criteria in determining its effectiveness. These were determined both clinically and through instrument methods. During this process, several essential problems were encountered:

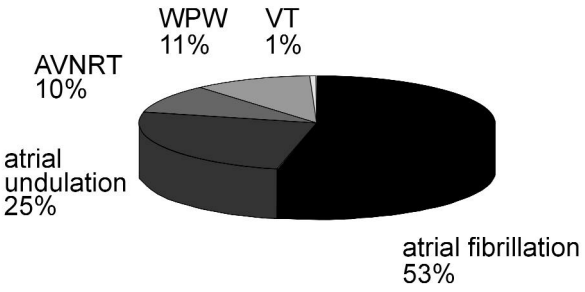

Figure 1. Disease distribution of the included patients resistant to medical intervention.

- It was not always possible to confirm the presence of an arrhythmia although the patients described it.
- Some of the patients had suspected sino-auricular node insufficiency.
- The patients noted a hyperactive cardiac frequency.
- The paroxysmal atrial flutter was present during the ambulatory control period.
- Medication usage was of minimal or no effect.

Temporary cardiac pacing is widely used for both diagnostic and medical purposes. Invasive or intracardiac electrophysiological research (IEPR) is extensively used in clinical work to localize additional conduction pathways, the "reentry" mechanism, ectopic foci and much more. The information achieved through IEPR has reached new heights, but unfortunately there are still some limitations:

- The introduction of the endocardial electrode is an invasive method, necessitating a qualified doctor and the use of aseptic conditions.
- A risk of complications exists in connection with puncturing the deep veins (subclavian, femoral); thromboembolisms, and septic complications, especially if the electrode remains in place permanently.
- The possibility of dislocation of the endocardial electrode.
- The limited possibilities of frequent repetition.
- It is performed only in hospital settings.
- The equipment is expensive.

Materials and Methods

Due to the drawbacks of IEPR, we have chosen other methods to obtain information about the cardiac conduction system. The method we have chosen, transesophageal pacing (TE P), is relatively simple; it results in fewer complications, is used in the

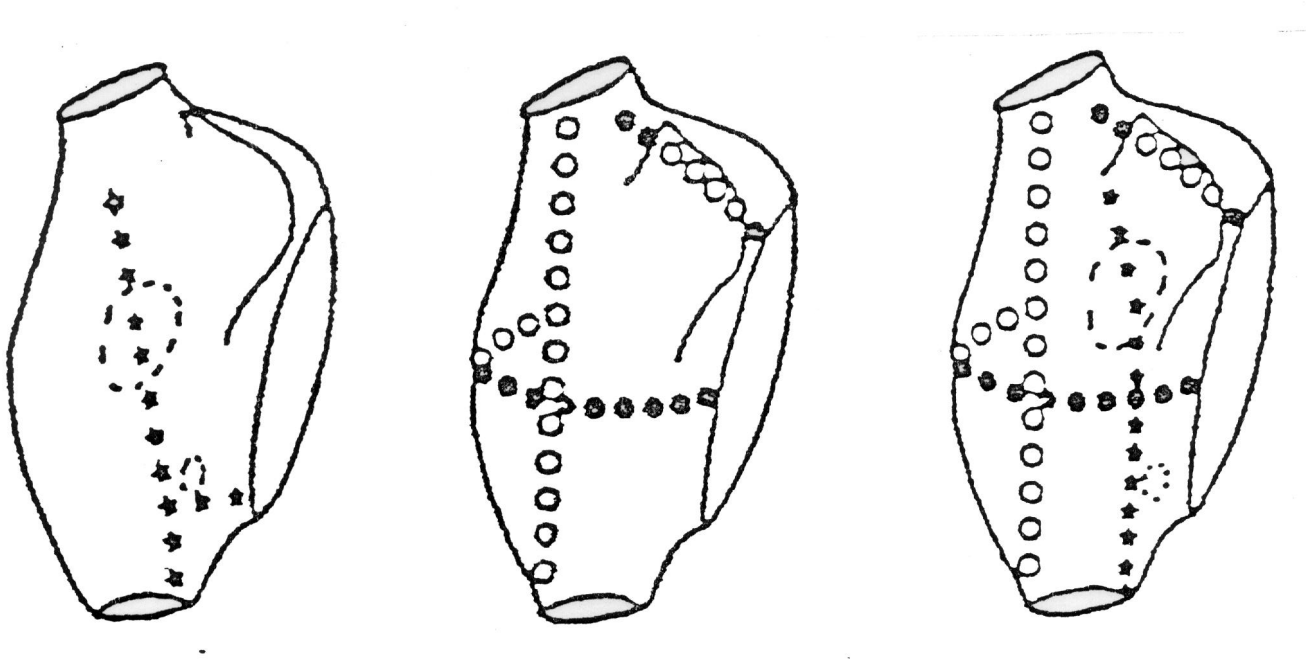

Figure 2. Schemes for the Maze surgical procedure on the right atrium.

ambulatory setting, and still provides sufficient information. It also takes into account the previous experience and results of the clinic [7].

The first Latvian TE pacing was performed in1983 [J. Jirgensons, J. Karpovs]. At present approximately 800 diagnostic and medical non-invasive procedures have been performed at the Latvian Clinic of Cardiology. The TE ECG method was first described by Cremer in 1906. The first experimental ventricular transesophageal stimulation was performed in 1952. Zol, Rowe et al. (1969) and Urbaszed et al. (1970), described successful implants in animals. However, the ventricular pacing resulted in some problems, including a high-tension current (causing conduction disturbances), possible burns of the esophagus, pain and irritation. The successful TE P of a patient with third degree AV block, described by Burack and Furman in 1969, resulted in many researchers using this method [Montoyo 1973, Bredikis 1981, Santini 1979, Gallagher 1980].

TE P can be used for the following purposes:

- determining the sino-auricular node functions;
- determining the atrioventricular [AV] and ventriculoatrial [VA] conduction pathways;
- researching the mechanism of arrhythmia;
- diagnosing additional latent AV and hidden VA conduction pathways;
- performing cardioselective stress testing on patients with coronary heart disease who, under certain circumstances, cannot perform classical stress testing;
- determining the effective treatment of arrhythmias;
- in the treatment of paroxysmal supraventricular arrhthymias and in some individual cases of ventricular arrhythmia. In our clinic it is always the method of choice in the treatment of atrial flutter.

TE P can be used at different stages in the diagnosis and treatment of arrhythmias:

- in functional diagnostic rooms in ambulatory care settings;
- in specialized cardiac electrophysiological research rooms;
- in radiodiagnostic and coronary angiography rooms with IEPR;
- in general cardiosurgery;
- in the reanimation departments;
- in specially equipped ambulances with emergency medical personnel [14].

TE P is used as a valuable screening tool prior to using IEPR. When introducing the electrodes, we prefer a transnasal approach because:

- An electrode can be better positioned.
- There is less discomfort for the patient as it enters the throat and the cough reflex is either absent or minimal.
- It is possible to communicate with the patient.

The electrodes should meet the following requirements:

- insertion through the nose;
- minimal nasal and esophageal irritation;
- flexibility;
- possibility to perform mono- and bipolar stimulation, as well as to inscribe mono- and bipolar TE ECG;
- stable contact with TE P and TE ECG during the time.

The electroimpulse amplitude necessary to perform electrocardiostimulation is 10-20 times as high as in the case of endocardial ECS. The advisable parameters for such pacemakers are as follows:

- The duration of impulse is 2,10,15 ms.
- The impulse should be linear.
- There is a range of frequencies in different regimes including:
  1. 50-180 impulses/min;
  2. 180-360 imp./min;
  3. 360-1400 imp./min;
  4. programmed pacing.

The amplitude of the impulse requires a gradual regulation in the range of 0-100 mA. At the same time, more than 40 mA are normally necessary for the ventricular stimulation. An electrode was usually introduced while lying on the back. Local anesthesia was not commonly used, although it is possible to perform the anesthesia of the throat with 10% Lidocaine SPRAY or to drop it into the nose. Premedication with sedative drugs (Diazepam) was usually used on anxious patients. Narcotic analgesics were added to the proximal atrial undulative cupping because the current used was higher than diagnostic pacing as the threshold of stimulation can not be determined. The optimal localization of the electrode was usually determined according to TE P (Figure 3) and test stimulation. Radio equipment can also be used. We used bipolar

Figure 3. The esophageal lead could be positioned with the help of a surface ECG.

stimulation, where positive and negative poles were separated by approximately 3-4 cm, which was not difficult to perform with our multipolar electrodes.
At work, we used the PEMD-6, PEMD-9 (Figure 4, 5), produced in the former USSR, that leads with 6 and 9 poles that helped to vary easily with registration and EST localization. The diagnostical appliance CardioCOMP-2 (Cordelectro, A. Kirkutis et al.), produced in Kaunas (Lithuania) includes a computer-conducted ECS, especially adjusted for TE P necessities. For AU induction and cupping, we used pacemaker UHS-20 (BIOTRONIK) with our specially designed impulses transformer. The duration of impulses varies from 5-10-15 ms, there is a possibility to change the amplitude in the range of 0,12,16,20 mA. In all patients, the following was determined:

- the time of the sino-auricular node-function revival;
- the sinoatrial conduction according to the method described by Strauss et al. in 1970 and by Richter in 1975;
- the transmission of the atrioventricular node, or Wenckebach point;
- the refractal periods of the atrioventricular node;
- the provocative tests for the possible arrhythmia to cause, were performed.

The post-operative control was performed according to the following scheme: 3 days, 7 days, 1 month, 3 months, and regularly every 10-12 weeks 5 days before the conducting systems were separated from the affecting medicaments. The control included WEM ECHO-cg, Holter-M [HM] and the control of the conducting system. We used the TE P on all the patients. We controlled the function of the sino-auricular node and the AV node performed the planned TE P.

Results and Discussion

There were 16 patients without clinical symptoms, 10 patients with some complaints, and 6 patients noted stable relapses. At the time of TE P control, AU was induced in 10 patients, those cupped with TE P (Figure 6), temporary ectopic atrial tachycardia (EAT), 4 patients, corresponding to the clinical data. The patients did not get hospitalized, the check time took 3-5 hours plus 3 hours some other day after HM data analysis. The repeated invasive examinations were performed on 8 patients with AU, and on 2 patients

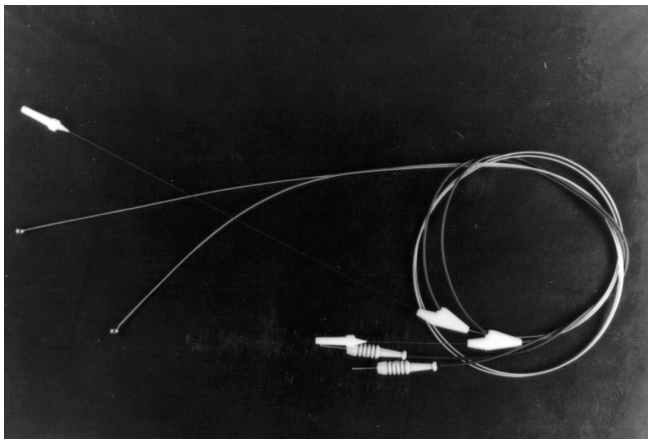

Figure 4. The multipolar lead PEMD-6 used during the investigation.

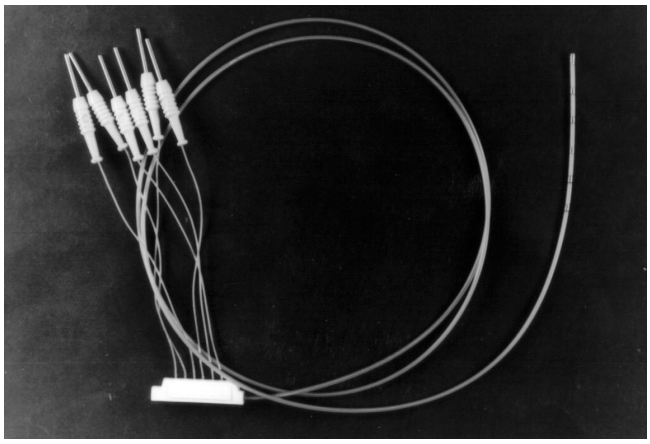

Figure 5. The multipolar lead PEMD-9 used during the investigation.

with EAT, whom later additional antiarrhythmic drugs were ordered to. Four of them had a repeated RFCA according to F. Cosio methods. After the performed RFCA procedure on the His bundle, a DDDR system was implanted in those patients still suffering from paroxsymal AF.

The drawbacks of the method should also be noted, however they are mostly connected with methodology. If the following problems were encountered during the procedure, they could be rectified:

- It is impossible to introduce an electrode through the nose. In such cases it should be introduced through the mouth.
- The dislocation of the electrode during the procedure. The electrode is positioned with a special fastener that usually does not cause any discomfort to the patient.
- If it is necessary to increase the amplitude, causing painful irritation to the patient, extend the distance between the poles of the electrode and increase the duration of the impulse.
- If the strengthening of the diaphragm and sternum musculature reaction is noticed, the distance between the stimulating electrodes should be prolonged as well as the impulse duration.
- If there is burning and pain behind the sternum, on conditions that there is no patient examination of the coronary cardiac diseases, then the amplitude should be decreased and the impulse duration should be prolonged.

Figure 6. The esophageal ECG clearly shows the induced AU and also its termination by TE P.

- The irritation in the throat and nasopharynx can be prevented by evacuation of the stylet from the electrode or performing anesthesia of the throat enter.
- The inscription disturbances can be prevented by using special filters during TE ECG inscription. [ECG FA-03, Cordelectro].

Conclusions

- TE P is a relatively simple and sufficiently informative method in diagnosing pathology of the cardiac conduction system.
- It is a selective method for the high-quality stabilization of rhythm in the case of paroxysmal atrial flutter.
- It does not require large capital investments, highly specialized equipment, or the ability to perform cardiac catheterization.
- TE P can be performed in an ambulatory setting. The information can be used to evaluate the patient's conduction system after the catheter ablation.
- TE P lacks some information from a methodological standpoint, but does not cause an increased probability of risk.

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